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APPLIED ERGONOMIC REPORT ON:

Henry Satrowsky
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Introduction

In the analysis of this case, I telephonically interviewed Mr. Satrowsky on January 13, 2007. I used standard accepted ergonomic methodology consisting of: 1) work task analysis; 2) assessment of hazard reduction; 3) assessment of medical surveillance; and 4) assessment of education and training. This methodology is recognized by ergonomic authorities and is cited in the following publications: *Work Related Musculoskeletal Disorders (WMSDs): a reference book for prevention*, 1995, in the National Institute for Occupational Safety and Health (NIOSH)'s *Elements of Ergonomics Programs*, March 1997, and in Occupational Safety and Health Administration (OSHA)'s *Ergonomics: The Study of Work*, 1991, revised 2000. This methodology has been adopted by the Association of American Railroads (AAR) in the publication entitled "*Ergonomics Programs at Heavy, Industrial Corporations*" February 1994. In addition to the aforementioned publications, I considered prior Carman and Carman/Inspector site inspections and reports as well as the following:

Documents Reviewed

- Complaint of Henry Satrowsky, Filed April 26, 2004;
- Deposition of Henry Satrowsky, September 26, 2006;
- Operative Procedure Report, Dr. Genovese, February 29, 2000;
- Radiology Report, Saikewicz Olena, M.D., July 17, 2001;
- Radiology Reports, Stephen Peck, M.D., August 3, 2001 and June 1, 2002;
- Medical records of Katherine S. Upchurch, M.D., Initial Evaluation February 14, 2002, Follow up Reports, May 23, 2002 and November 21, 2002, Letter dated January 30, 2003;
- *Musculoskeletal Disorders and Workplace Factors*, National Institute for Occupational Safety and Health (NIOSH), July 1997;
- American Railway Engineering and Maintenance of Way Association (AREMA) ballast standards;

- Federal Railroad Administration, "Examination of Railroad Yard Workers Safety," July 2001;
- AAR publication, Basic Ergonomics: Principles and Techniques, 1992;
- Ergonomics Programs at Heavy Industrial Corporations, Association of American Railroads, 1994;
- United States General Accounting Office, Worker Protection, Private Sector Ergonomics Programs Yield Positive Results, August 1997;
- American National Standards Institute, *Control of Work-Related Cumulative Trauma Disorders* (ANSI Z-365);
- FRA's Track Safety Standards, 49 CFR 213
- American Railway Engineering and Maintenance of Way Association (AREMA) ballast standards
- *Job Analysis Summary of Carman*, C.H. Lawshe, dated 5/12/77
- *Impact of Railroad Ballast Type on Frontal Plane Ankle Kinematics During Walking*, by Andres, R.O., Holt, K.G., and M. Kubo, Applied Ergonomics 36:529-534, 2005
- American National Standards Institute, *Management of Work-Related Cumulative Trauma Disorders* (ANSI Z-365);
- *Ergonomics Program Management Guidelines For Meatpacking Plants*, US Dept. of Labor, Occupational Safety and Health Administration (OSHA) 3123, 1990;
- OSHA, Advanced Notice of Proposed Rulemaking (57 Fed Reg. 34192);
- *Ergonomics: The Study of Work*, US Dept. of Labor, OSHA 1991**;**
- *Ergonomics: The Study of Work*, US Dept. of Labor, OSHA 3125, 2000 revision;
- *Occupation as a Risk Factor for Knee Disorders*, Scand J Work Environ Health 1996; 22:165-75;
- *Osteoarthritis of the Hip and Knee and Mechanical Occupational Exposure-A Systematic Overview of the Evidence*, The Journal of Rheumatology, 1997, 24:8.)

Background

Mr. Satrowsky was born on December 2, 1944. He is a high school graduate. He served in the Army form 1963 to 1966. Then was a union carpenter for a few years. He primarily worked construction before beginning work for Boston and Maine Railroad in April of 1976. He began as Carman helper, was promoted to Carman after three years. He primarily worked out of the Deerfield Shop. He worked for short periods of time at other shops during the early part of his career. During the last ten years of his career he worked in the shop area about 25 percent of the time and 75 percent of the time he worked in the yard as Carman inspector. As a Carman inspector he conducted car inspection, conducted air tests and performed running repairs. Running repairs consisted of repairing safety appliances, replacing brake shoes (estimated 15 to 30 per shift), replacing knuckles about once per week, replacing bolts and cotter keys.

Medical

Mr. Satrowsky was diagnosed with heel spur syndrome, plantar fasciitis of the left and right feet. Pain was more severe on the left. Mr. Satrowsky underwent conservative treatment including three cortisone injections and physical therapy without significant relief. Dr. Genovese performed endoscopic plantar fasciotomy of the left foot on February 29, 2000. He got good results from the surgery and returned to work.

After approximately two years the pain returned and he sought treatment from Katherine S. Upchurch M.D. on February 14, 2002. Mr. Satrowsky complained of diffuse joint pain in his feet and ankles, with symptoms made worse by walking and standing while working. She prescribed Ultram and Bextra. An MRI conducted on June 1, 2002 revealed evidence of plantar fasciitis and degenerative osteoarthritis.

In April of 2002, Mr. Satrowski got bumped from the East Deerfield Shop to the Lowell Shop, which is a drive of approximately 100 miles round trip. He consulted with Dr. Upchurch about the travel and his medications. She recommended that because he was taking Ultracet and would be working 12 hour shifts plus overtime that he not take the assignment at the Lowell Shop. Mr. Satrowski decided not to take the assignment and he was laid off. He last worked in April 2002.

In a January 30, 2003 letter Dr. Upchurch diagnosed multi-site osteoarthritis of the feet and ankles, as well as carpal tunnel syndrome. "His is difficult to treat and particularly in the setting of significant foot involvement contraindicates any job which requires significant standing, walking, stooping, bending, crouching and the like. Additionally, his hand osteoarthritis produces pain which is exacerbated by fine motor or repetitive movements, as is his carpal tunnel syndrome. It is my clinical opinion that he will not be able to return to gainful employment in any capacity in which his functional capacity as outlined on the attached form is exceeded." He currently is prescribed Beckstra for arthritis and Ulracet for pain.

Work Tasks and Environment

At the Deerfield Shops Mr. Satrowsky worked in the yard inspecting railcars and performing running repairs. To perform these work tasks Mr. Satrowski walked on "3 inch ballast." He stated in his deposition on page 43, that there were "a lot of holes in the yard were like a 'V.' A lot of times they would put ballast down, out in the center of the tracks and wouldn't level it for days. And when winter came the snow was on it." He also stated. "If they had used smaller ballast my feet wouldn't roll. It would be more solid. I complained about them leaving ballast in the center of the track, and they said they'll just continue using those tracks." (Pg 44) The ballast caused him to slip and sometimes fall. His feet would roll. There was a lot of debris between the tracks, and the ballast was not level.

As a carman/inspector, he worked in the receiving and departure yards, which had main line ballast. He estimated that he would spend 75 to 80 percent of his shift on his feet walking and working on main line ballast that was uneven and had debris. He worked eight hour shift with an average of ten to fifteen hours of overtime per week.

He estimated that it would take one and a half to two hours for inspection, air tests and running repairs of 50 to 60 cars. He would inspect, air test and repair an average of three consists and up to five per shift. Mr. Satrowsky estimated that he would walk at least four to five miles per shift, and up to approximately seven miles per shift. When inspecting he would connect at least 150 to 200 air hoses, turn at least 30 to 60 angle cocks, set 0 to 5 hand brakes, and release 0 to 5 hand brakes. For running repairs he would use 4 and 5 foot pry bars, come-alongs to close doors, cutting torches, welding equipment, and wrenches. When assigned to shop repair he would work on concrete, asphalt or gravel, depending on the location of the car being repaired.

To perform his job with the railroad, Mr. Satrowsky was frequently required to walk and work on large ballast, uneven surfaces, and slippery surfaces. Mr. Satrowsky had to squat or kneel when coupling air hoses, replace knuckles, inspecting air brakes, inspecting under the cars, checking for air leaks under the cars, attaching a brake hose, and visually inspecting air valves in the middle of the cars. He had to climb ladders on the sides of cars to set and release handbrakes.

Analysis

Ballast is a selected, crushed and graded aggregate material used upon the railroad roadbed for the purpose of providing support for rail and ties; drainage, stability and uniform distribution of loading from rolling stock. There are several different sizes or gradations considered acceptable for use as railroad ballast depending upon where it is used. Generally AREMA sizes 3, 4 and 4A are acceptable and normally used for main line applications while sizes 5 and 57 are considered acceptable and normally used in railroad yards and industrial tracks. Yard and industrial track ballast are generally graded from 1 inch to 3/8 inch to provide improved walkway and safety conditions along the track. Ballast in walkway areas should be level, at or below the top of ties, uniformly graded, properly sized and free of debris and other foreign material, which may cause tripping or falling hazards.

These standards are generally followed by the rail road industry, and considered Industry Standards. Mr. Satrowsky reported that the Deerfield Shop receiving and departure in which he worked generally had large and uneven ballast with debris and slopes. Further, he reported that he would squat or kneel to connect air hoses, replace brake shoes, inspect and make repairs.

The AAR publication, Basic Ergonomics: Principles and Techniques, 1992, states in chapter 2, that “Repetitive crouching, squatting, kneeling, and flexing of the ankle are the primary actions contributing to the compression and wear and tear of tissues of the lower extremities.” The same publication identified job factors which increase wear and tear on the joints as repetition, duration, posture, force of exertion, and contact stress.

The Federal Railroad Administration (FRA) publication "Examination of Railroad Yard Workers' Safety" states in section 7.3.1 that factors contributing to yard injuries include debris in the yards and the use of mainline ballast on towpaths. It also states mainline ballast is difficult and uncomfortable to walk on. Walking ballast, or three quarter inch rock, has been found easier and more comfortable to walk and work on. The FRA also listed under best practices at section 8.2, to provide adequate lighting for night work, remove trash, debris, and other slip and trip hazards from the yard on a regular and frequent basis and use "walking" (i.e. ¾ in.) stone on switch leads and tow paths. Further, Robert O. Andres, stated in *Impact of Railroad Ballast Type on Frontal Plane Ankle Kinematics During Walking*, Applied Ergonomics, 2005, 36: 529-534, that the overall finding from this study is that walking on *main line ballast* significantly increases the biomechanical loading of the lower extremities compared to walking on *walking ballast*. It was further stated, that these increased stresses, over the course of a railroad career, can lead to chronic and acute disorders in the lower extremities.

The American National Standards Institute has stated in its draft of *Control of Work-Related Cumulative Trauma Disorders* (ANSI Z-365) that although the studies in the literature reviewed show a link between the identified risk factors and the development of WMSDs, the literature does not permit threshold or maximum levels of exposure to be determined. These risk factors have been recognized in the literature and in industry since the 1970's. In the early 1980's, heavy industry in the United States was actively involved in establishing engineering controls to eliminate worker risks related to exposure to the risk factors for WMSDs. Such programs consist of job analysis, active and passive medical management, engineering controls, administrative controls, and employee and supervisory education and training.

Based on the above, it is my opinion that long-term climbing, squatting, kneeling, and walking on large ballast exposed Mr. Satrowsky to repeated excess stress and direct pressure on lower extremity regions. It has been known since the 1970's, by ergonomists and by industry, that the more force that is exerted on the joints, the more repetition of loading, and the more frequent non-neutral postures associated with occupational activity, the more one is put at risk for developing WMSDs of the lower extremities. Since the 1980's, ergonomists and heavy industry have put into place ergonomic safety programs to reduce and eliminate jobs and job activities that put undo stress on a worker's joints. In 1994 the AAR reviewed ergonomic programs at heavy industrial corporations. It stated that each company studied reported leveled or reduced incident and severity rates of injuries. In *Ergonomics Programs at Heavy, Industrial Corporations*, the AAR identified six elements of a "safety improvement process." These elements are 1) – Define and Design the Work Processes; 2) Worksite Analysis And Monitoring; 3) Analysis of Problems and Solution Options; 4) Implementation of Solutions; 5) Training and Education; and 6) Medical Management.

Literature regarding plantar fasciitis states that plantar fasciitis results from placing stress on the feet. The plantar fascia acts like a shock absorbing bowstring, supporting the arch in the foot. However, if tension on the bowstring becomes too great, minute tears can occur along with

inflammation. The result is a stabbing pain that is usually worse in the morning because the fascia tightens or contracts overnight. In severe instances the foot may hurt with the slightest pressure, making walking difficult. Sometimes, plantar fasciitis is also associated with a growth of a bone spur that develops from tension on the heal bone. Risk factors are associated with spending a work shift on the feet. People with occupations that require a lot of walking especially on uneven surfaces, standing on hard or irregular surfaces can damage the plantar fascia. The main risk factor is physical activity that stress the plantar fascia. Gait abnormalities can cause inflammation of the structure attached to the heel bone resulting in inflammation of the plantar fascia. It is ergonomically and biomechanically logical that this can result from walking on large and uneven ballast with debris.

While performing his job at the Deerfield Shop, Mr. Satrowsky walked on main line at least six to seven hours per shift. He would have to squat to inspect and replace railcar brakes shoes, air systems, to connect air hoses, climb to set and release hand brakes and to make repairs.

Industry Knowledge of Ergonomic Hazards and Risk Factors:

OSHA has defined a WMSD as an injury to the muscles, joints, tendons or nerves that is caused, or made worse, by work-related risk factors. A basic and generally accepted ergonomic principle is that cumulative trauma to the lower extremities and low back is associated with repetitive motions, awkward postures, exertion, stability, and distance of tasks from the worker, and distance moved, and absorption of vibration.

Literature related to WMSDs indicates that there is a tendency for their development in people who engage in activities involving (1) repetition; (2) forceful exertions; (3) awkward postures; (4) mechanical stress; and (5) vibration. (E.g. *Occupation as a Risk Factor for Knee Disorders,* Scand J Work Environ Health 1996; 22:165-75; and *Osteoarthritis of the Hip and Knee and Mechanical Occupational Exposure-A Systematic Overview of the Evidence,* The Journal of Rheumatology, 1997, 24:8.) Literature regarding Plantar Fasciitis states that one cause is repeated stress on the heel or "repetitive foot use, such as from jobs or activities that require prolonged walking or standing on hard or irregular surfaces." (Plantar fasciitis, heel-that-pain.com; ww2.wvec.com).

In 1991, the Occupational Safety and Health Administration (OSHA) published meatpacking ergonomic guidelines in *Ergonomics Program Management Guidelines for Meatpacking Plants.* Subsequently, in August 1992, OSHA developed an Advanced Notice of Proposed Rulemaking for ergonomics guidelines for general industry based on the meatpacking guidelines (57 Fed Reg 34192). OSHA also published *Ergonomics: The Study of Work,* in 1991, and revised edition 2000, which was intended for industry generally instead of focusing on meatpacking. Four components of a comprehensive ergonomics program were identified as worksite analysis, hazard prevention and control, training and medical management. *The Study of Work* was published as part of a nationwide educational and outreach program to increase awareness and reduce cumulative trauma disorders. OSHA recently reiterated that a systematic

ergonomic program approach is the most effective way of reducing work related musculoskeletal disorders. The 2000 edition listed janitors and cleaners in the top ten occupations for MSDs. OSHA also stated in *Ergonomics: The Study of Work*, 2000 (revised), that WMSDs generally develop gradually over weeks, months, and years. OSHA states on pg. 2, "MSDs usually result from exposure to multiple risk factors that can cause or exacerbate the disorders…." OSHA also recently stated, "no one will ever be able to say that X number of repetitions or lifting X pounds will result in injury or conversely that Y number of repetitions or Y pounds will definitely not result in injury for anyone, any time, anywhere. However, many employers have proven that establishing a systematic program to address such issues as repetition, excessive force, awkward postures and heavy lifting, results in fewer injuries to workers."

In November 2000, OSHA published its Ergonomic Program; Final Rule. It stated at 65 Fed Reg 68483, "Work-related disorders of the lower extremities have not received the same scrutiny as those of the upper extremities and back. However, existing information from pathophysiology, epidemiological studies, and biomechanical investigations implicate physical work factors related to repetitive, forceful exertion and awkward posture to these disorders, especially osteoarthritis of the knee and hip." OSHA further stated, "It is well recognized that acute trauma can trigger osteoarthritis, but there is also evidence that less substantial, but repetitive, forces to the joints can lead to micro fractures of the articular cartilage and subchondral bone …in a population-based case-control study." OSHA concluded, at 65 Fed Reg 68486, "strong evidence is available showing that osteoarthritis of the knee and other WMSD's of the lower extremities can result from exposure to the combined physical work-related factors of repetition, force and awkward posture." Finally, OSHAconcluded "that the evidence reviewed in this section demonstrates that workers who perform job tasks requiring repeated forceful flexion of the knee or other joints of the lower extremities are at increased risk of serious musculoskeletal impairment such as osteoarthritis."

Research studies indicate that the highest rates of WMSD's occur in occupations and job tasks with high work demands for intensive exertion, as was experienced by Mr. Satrowsky in the performance of his work tasks. The National Academy of Science publication, *Musculoskeletal Disorders and the Workplace*, stated, at page 363, "In conclusion, a clear and strong pattern of evidence emerges after considering the epidemiologic, biomechanical, basic science, and intervention literature collectively. We can conclude with confidence that there is a relationship between exposure to many workplace factors [i.e. repetition, force, vibration, and the combinations of repetition and force and an increased risk of musculoskeletal disorders."

NIOSH published *Elements of Ergonomics Programs* in March1997, and outlined what a reasonable employer should do to prevent WMSDs. It also provided tools to accomplish the implementation of a proactive ergonomics program. The elements of ergonomic safety programs are:

a) Work site analysis;
b) Hazard and prevention control;
c) Medical Management; and
d) Worker training and education

The 1997, NIOSH review of research performed and published in the 1980's and early 1990's, *Musculoskeletal Disorders andWorkplace Factors,* indicates that the evidence supports that exposure to a combination of job factors studied increases the risk for WMSDs, which is consistent with the evidence that is found in the biomechanical, physiological, and psychosocial literature. This is consistent with the evidence that is found in the biomechanical, physiological and psychosocial literature..

The 1991, AAR Ergonomic guide cited repetition, duration, posture, force of exertion, and contact stress, as factors related to CTDs. The Long Island Railroad has had a published ergonomic program since the early 1990's. The American Association of Railroads has been providing the United States Railway Industry with information for the development of ergonomic programs that would minimize worker exposure to the risk factors for WMSDs.

Conclusions

1. It has been known since the 1970's, by ergonomists and by industry, that the more force that is exerted on the joints, the more repetition of loading, and the more frequent non-neutral postures associated with occupational activity, the more a worker is put at risk for developing WMSDs of the lower extremities.

2. Since the 1980's, ergonomists and heavy industry have put into place ergonomic safety programs to reduce and eliminate jobs and job activities that put undo stress on a worker's joints.

3. While performing his job with the Boston and Maine Railway Company, Mr. Satrowsky was exposed to the above-cited risk factors when he was required to work and walk on large mainline ballast, uneven and slippery surfaces.

4. The Boston and Maine Railway Company did not meet industry standards with adequate ergonomic safety programs in regards to Mr. Satrowsky because:

    a) The railroad did not do any work task analysis of his job to see if walking and working on large ballast and unstable surfaces posed any risk of injury;
    b) The railroad did not implement any hazard prevention and control measures in Mr. Satrowsky's job to reduce his exposure to excessive stress to his lower extremities. Boston and Maine Railway Company could have followed industry standards and put small walking ballast in the receiving and departure yards and maintained it so that he was not exposed to the excessive stress from working on large ballast;
    c) Boston and Maine Railway Company failed to implement any medical management programs to identify and monitor any workers at risk for injury.

d) Boston and Maine Railway Company failed to meet the standards of an adequate ergonomic program when it failed to train and educate Mr. Satrowsky about the risk factors for developing injuries to the lower extremities knees.

5. By having large ballast, Boston and Maine Railway Company violated industry standards as set forth by AREMA. The AREMA Manual for Railway Engineering, provides at section 2.10.4 Ballast Gradations (1988) that rail yards and some industrial track gradations are generally graded from 1 inch to 3/8 inch (AREMA No. 5 gradation, Table 2-2), to provide improved walkway and safety conditions along the track.

Thus, my opinion, to a reasonable degree of ergonomic certainty, is that Mr. Satrowsky, while performing his job with the railroad, was exposed to the risk factors associated with WMSDs of the lower extremities. The railroad allowed large ballast in areas where employees were known to work thereby violating industry standards. It is my opinion, within a reasonable ergonomic certainty, that Boston and Maine Railway failed to provide Mr. Satrowsky with a reasonably safe place to work.

I reserve the right to change or modify my opinions based on any additional information that I may be furnished in the future that was not available to me at the time of the preparation of this report.

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